ISSUED BY THE COLONIAL OFFICE

East African Agricultural Research Institute AMANI

Report for the year 1946

Crown Copyright Reserved

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1947
SIXPENCE NET

Colonial No. 213

EAST AFRICAN AGRICULTURAL RESEARCH INSTITUTE*, *AMANI*

Report for the year 1946

STAFF LIST AS AT 31st DECEMBER, 1946

Director, A. G. G. HILL, B.A., B.Agr., B.Sc., A.R.C.Sc. (*returned from leave* 15/8/46).

Plant Pathologist, H. H. STOREY, M.A., Ph.D., F.R.S. (seconded to Colonial Office).

Assistant Plant Pathologist, R. F. W. NICHOLS.

Entomologist, T. W. KIRKPATRICK, M.A., Dip.Agr., F.R.E.S. (proceeded on leave pending retirement on 19/6/46).

Soil Chemist, D. W. DUTHIE, M.A., B.Sc., Ph.D., F.R.I.C.

Assistant Soil Chemist (vacant).

Biochemist, R. R. le G. WORSLEY, A.R.C.S., B.Sc., Ph.D. (seconded to Veterinary Research Laboratory, Kenya).

Plant Physiologist (1), F. J. NUTMAN, D.Sc., D.I.C. (seconded as Director, Clove Research Scheme, Zanzibar, from November, 1946).

Plant Physiologist (2), J. GLOVER, M.Sc. (proceeded on leave 2/9/46).

Geneticist, L. R. DOUGHTY, B.Sc. (seconded as Director, Cinchona Research Organization).

Botanist, P. J. GREENWAY, F.L.S.

Secretary and Librarian, R. E. MOREAU, C.M.Z.S. (invalided June, 1946).

Assistant Secretary and Librarian, Miss P. M. LEAKE, B.Sc. (selected but has not assumed duty).

Temporary Clerical Assistant, Mrs. L. GOLDSTUCKER.

Superintendent of Plantations, L. M. FERNIE (proceeded on leave 15/3/46).

Assistant Superintendent of Plantations, W. B. MAY (assumed duty 12/8/46).

Temporary Assistant Superintendent of Plantations, F. KING-SMITH (resigned 31/8/46).

Engineer, T. V. GREENWOOD.

* *Known as the East African Agricultural Research Station prior to* 1944.

INTRODUCTION

This is the last annual report of the East African Agricultural Research Institute which will appear.

The Amani Institute was originally founded, under German administration, as long ago as 1902. After the first World War the Institute fell into desuetude but was reopened, under British administration, in 1928 as one of the proposed chain of long-range agricultural research institutes serving the British Empire, its status being that of an independent, inter-territorial department under the control of the Secretary of State and supported by funds provided by H.M. Government and the six East and Central African territories. This decision of 1928 to establish an East African Agricultural Research Station for long- and wide-range agricultural research was farsighted, but the decision to establish it on the remote Amani site in the depths of mountain rain-forest was unfortunate and has proved a constant hindrance to progress. Despite the many disabilities from which it has suffered, the Institute has carried out valuable work during the 17 years of its existence but it has been increasingly recognised in recent years that a strong case existed for re-siting and expanding the Institute. This question was first raised officially at the Conference of Directors of Agriculture in May, 1940, when proposals were made by the Director of Agriculture, Uganda, for the re-organisation of East African agricultural research on a regional basis. In 1944 detailed proposals for the re-organisation and re-siting of the East African Agricultural Research Institute were prepared by me and considered by the newly-formed Standing Agricultural Research Committee at its first meeting. As a result of this committee's recommendations modified proposals were drawn up and later approved by the East African Governments and the Secretary of State in 1945. These proposals, since abandoned, contemplated the acquisition of a new headquarters site for the Institute near Kabete with sub-stations in the lowlands and highlands, mainly for food-crop experiments. In February, 1946, Sir Frank Engledow and Professor J. W. Munro, representing the Colonial Agricultural Research Committee, arrived in East Africa and were joined by Sir Harold Tempany, Agricultural Adviser to the Secretary of State, who had arrived earlier. After making an extensive tour of East Africa the members of the delegation prepared a series of memoranda which formed the basis for discussion at a research conference held in Nairobi.* The recommendations made at this conference included proposals which, in so far as they concerned central agricultural research, went far beyond any earlier ones in that they included proposals for the creation of an East African Agricultural Research Organisation, with headquarters in Kenya, embracing all agricultural and related research in East Africa. Under this scheme the East African Agricultural Research Institute, Amani, will be absorbed into the new organisation and so will cease to exist as an independent department.

---

* Vide, East African Research: Agriculture, Animal Health & Forestry; Proceedings of Conference held in Nairobi on 21–22 March, 1946. Government Printer, Nairobi.

Soil Science: As in previous years the work of the Soil Chemist was seriously handicapped by the complete lack of assistants, the posts of Assistant Soil Chemist and Scientific Assistant, vacant for four years, having remained unfilled through lack of suitable candidates.

The most important investigations with which the Soil Chemist was concerned during the year were the field-trials with Uganda silico-phosphates which are being conducted by the East African departments of agriculture. Much depends on the outcome of these experiments since unless the soil fertility on native farms can be raised by some means, particularly in thickly-populated areas, the time will come when East Africa cannot feed its own peoples. The results of these phosphate trials are coming to hand and will be analysed here as soon as possible in order that the authorities can decide whether to proceed with the proposed scheme for manufacturing calcined silico-phosphate from Uganda deposits.

Other activities of the Soil Chemist were: the preparation for publication of a 1 : 4 million soil-map of Tanganyika based on Milne's provisional soil-map of 1935; co-operation with the Tanganyika department of agriculture in the laying down of soil fertility trials in the proposed European settlement areas of the Southern Highlands; and an investigation into the increasing soil salinity in irrigated sugar-cane fields. The Soil Chemist's report on these activities appears on a later page.

Plant pathology: The activities of the pathology division for the past nine years have been concentrated for the most part on the attempt to produce virus-resistant clones of cassava, a staple native food-crop in parts of East Africa and a valuable famine reserve in other areas. This work is described by the Assistant Plant Pathologist later in this report and, more fully, in the *East African Agricultural Journal,* Vol. XII, No. 3. Briefly the procedure is as follows. Controlled crossings are made from the most promising varieties and species established at Amani, the resulting seed being germinated in laboratory incubators and the seedlings raised in green-houses. These seedlings are then multiplied vegetatively, preparatory to a preliminary field trial in which the more susceptible clones are eliminated. This preliminary trial is followed by replicated field-trials, the survivors from which are subjected to grafting tests to confirm their apparent resistance to virus infection. The time taken to breed and test one generation in this way is about three years. The progress of the work in 1946 is described below.

This long-term cassava breeding project has not yet reached the stage where any of the new varieties can be released for general distribution.

Although unsuitable for most agricultural investigations the Amani site is particularly well suited for cassava breeding and selection work.

Plant physiology: Only one plant physiologist was on duty during the year, his investigation being confined to a preliminary study of soil-water-vegetation relations in the Shume area of the West Usambara Mountains, Tanganyika. These studies were mainly confined to devising and testing field apparatus for measuring soil-moisture beneath different types of vegetation; also the run-off and penetration of rain on cultivated and uncultivated land of varying degrees of steepness. The investigation soon showed that the method devised, although capable of providing some of the information required fairly rapidly, would be too slow or excessively costly for an investigation which, if it is to be of any value, must be carried out over wide areas. These preliminary studies resulted in some interesting observations which are recorded in the Plant Physiologist's report below.

It has been suggested that future work on the soil-water-vegetation complex should be confined to a study of the problem as it affects drought-resistance in native food-crops in semi-arid areas. The results from such a study should be of inestimable value to plant-breeders engaged in breeding and selecting drought-resistant crop varieties.

Systematic Botany: Despite the fact that the Systematic Botanist continues to work single-handed, steady progress was made during the year. Almost 3,100 determinations were made and reports on a wide range of botanical subjects prepared for numerous enquiries. In the course of making these determinations a further 13 type-specimens were discovered in the Herbarium. Descriptions of 16 new species from this Institute were published, making a total of 398 known isotypes in the Amani Herbarium, where the total number of specimens is now over 54,000. Over 6,300 named specimens were distributed during the year to herbaria in England, the U.S.A. and South Africa. Only 44 specimens were received in exchange from other herbaria.

Some 127 consignments totalling 5,139 specimens were sent in for identification by technical departments, business concerns and others.

The number of sheets loaned to various institutions and individuals for study was over 430.

At the request of the Tanganyika Forest Department a provisional list of plant names in four vernaculars was prepared by Mr. Greenway, excluding Kiswahili, for which a dictionary of plant names was published in 1937.

Apart from herbarium activities the Systematic Botanist found time to carry out: a vegetation-survey of Mt. Hanang in the Great Rift Valley; a further weed-survey of the Northern Province Wheat Scheme lands and a preliminary vegetation-survey of part of the Nyanza Province of Kenya in connection with cinchona research.

Owing to the untimely and much lamented death of Clement Gillman in October it has not been possible to complete the 1:1,000,000 vegetation map of Tanganyika which Mr. Gillman had undertaken to draft for the Vegetation Classification Committee, of which I am chairman.

Library: Owing to the sudden departure on sick-leave of the Secretary-Librarian in June and absence of an Assistant, some difficulty was experienced in tabulating and indexing the mass of incoming literature. There has been a considerable and welcome increase in the number of technical officers throughout East Africa who make use of the services offered by the library.

East African Agricultural Journal: This publication has been edited by the Director of the Institute since the journal was founded in 1935. With the abolition of the Institute a new editor must be found.

It is much to be regretted that Mr. Moreau had to give up his work as Assistant Editor, a post which he ably filled for 10 years.

The standard of publications submitted for publication during the year was maintained, but the number presented was lower than in previous years. Two thousand copies of each issue are now printed.

Plantation Work

All plantations were maintained, as in previous years. These Amani plantations, which cover a mountain-side extending from 1,500 to 3,700 ft. a.s.l., form a well-stocked arboretum of local and introduced species which is unique in East Africa. In my opinion provision should be made for the future maintenance of these plantations, even though the East African Agricultural Research Institute be abolished.

Native food-crops: The failure of the long-rains in 1946 resulted in the loss of most of the varieties in the food-crop collection.

Nursery: Owing to the acute food shortage all available land was put under food-crops. The demand for economic and ornamental plants and seeds continued.

Cloves: The experiments to find a method for propagating this tree vegetatively failed. Further trials will be made.

Rubber: The tapping of Ceara and Hevea trees at Sigi was discontinued in April when the demand for East Africa rubber ceased.

Central Plant Quarantine Station, Amani

The quarantine houses are now in a bad state of repair. No plants were introduced through quarantine during the year. A more conveniently situated plant quarantine station is needed for East Africa.

Kwamkoro Estate Re-development Scheme (C.D.F.)

This scheme was managed by the Cinchona Research Organisation during the year; an appropriate arrangement since that organisation now has a resident officer at Kwamkoro Estate, where much of the cinchona field work is carried out.

Crops.

Aleurites montana. Tung: The area under this crop is some 70 acres. The 1946 crop amounted to 5½ tons of nuts. Arrangements have been made whereby all nuts from Usambara plantations are bulked and the oil expressed by the Noorani Industrial Company, Tanga, and the oil exported. The oil from the 1946 Kwamkoro crop amounted to 1,424 kilos., which is being sold at £230 per ton.

Derris: No new plantings were made in 1946. The areas planted in 1943 were dug and shipped. From the 10 acres dug 8½ tons of root were obtained. The analysis and price are not yet known.

Coffee: Only 2¾ tons of clean robusta coffee were obtained. Owing to water shortage during the cropping season most of this had to be dried as buni. £50 per ton was obtained for the clean coffee f.o.r. Muhesa.

Cinchona: There are only 14 acres of old cinchona left of the original C.D.F. plantations, the other areas having been dug out and the bark marketed. The remaining 14 acres are being cut on a seven-year cycle, one-seventh each year. The yield of bark from the portion cut in 1946 was 1½ tons of dry bark.

General

The Plant Pathologist has taken over a plot on Kwamkoro for his breeding work on cassava.

An old German house near the factory is being renovated.

Publications, 1946

Empire Production of Drugs, IV Straphanthium; P. J. Greenway, *East African Agricultural Journal* 9, 184.

Specific Decapitalization, P. J. Greenway. Chronica Botanica (in press).

Camphor Production in East Africa, A. G. G. Hill, *East African Agricultural Journal* 11, 148.

The Selection and Improvement of Food Plants in Relation to Better Nutrition, A. G. G. Hill, *East African Agricultural Journal* 12, 125.

Oil Plants in East Africa, (i) Groundnuts, (ii) Sesame, and (iii) Sunflowers, A. G. G. Hill, *East African Agricultural Journal* (in press, December).

Allanblackia stuhlmannii, A Note on, A. G. G. Hill, *East African Agricultural Journal* (prepared for press).

Breeding Cassava for Virus Resistance; R. F. W. Nichols, *East African Agricultural Journal* 12, 184.

A. GLENDON HILL,
Director.

Amani.
February, 1947.

FINANCIAL STATEMENT

Forecast for 1946.*

Revenue

	£	£
His Majesty's (Imperial) Treasury	6,000	
Contributions :—Tanganyika	5,507	
Kenya	4,937	
Uganda	4,937	
Northern Rhodesia	570	
Nyasaland	570	
Zanzibar	570	
	23,091	
Local Revenue	1,352	
		24,443

Maintenance Expenditure

Personal Emoluments	7,996	
Passages	1,115	
Pensions and Provident Fund Contributions	952	
Cost of living allowances	547	
Laboratories	638	
Publications	35	
Office, Telephones and Contingencies	196	
Materials	491	
Freight and Transport	725	
Travelling	639	
Labour	2,977	
		16,311
Saving		8,132

Summary

Reserve on 1/1/46	15,262	
Saving on Maintenance	8,132	
	23,394	
Capital Expenditure 1946	1,167	
Estimated reserve on 31 December 1946	22,227	

* Final figures from Treasury not yet available.

RESERVE FUND

Financial Appreciation

	£	£
Estimated gross reserve on 1 January 1946		6,264
Estimated Revenue 1946 :—		
Government contributions	23,740	
Local sales	500	
		24,240
		30,504
Estimated Expenditure 1946 :—		
Recurrent	23,090	
Non-recurrent	1,745*	
		24,835
Estimated reserve at end of 1946		5,669
Estimated Revenue 1947 :—		
Government contributions	20,549	
Local sales	500	
		21,049
		26,718
Estimated Expenditure 1947 :—		
Recurrent	21,049	
Non-recurrent	—	
		21,049
Estimated reserve at end of 1947		5,669†

* Of £3,200 Non-recurrent expenditure authorised in 1946 Estimates only £1,745 approximately will be spent.

† There will be a contingent liability to be met from this fund for accumulated leave-pay when the East African Agricultural Research Institute accounts are closed on the Institute being absorbed into the new East African Agricultural Research Organization.

APPENDICES.

Soil Science: Report for 1946.

Staff and Laboratory. Neither an Assistant Soil Chemist nor a Scientific Assistant was appointed during the year, and in consequence the soil work was severely handicapped. As shortage of staff is likely to be a major problem for some years, I have tried out some of the new rapid semi-micro colorimetric methods of soil analysis, and these seem so promising that, after consulting the Pedologist at Rothamsted Experimental Station, I have ordered the apparatus and chemicals required for these methods. In view of the very low salary grade offered to African Technical Assistants, I can see little hope of obtaining suitable laboratory staff of this kind. The aim, I consider, should be to recruit European scientific assistants (possibly women with a pass degree in Science) and to adopt every means of raising the output of work per head.

The Soil Chemist of Cinchona Research Organisation, Dr. I. Armstrong Black, has been working in the soil laboratory since March this year.

I acted as Director of the Institute during June and July, and as Assistant Editor of the *East African Agricultural Journal* from June to October.

Visits. The following visits were made during the year:—

To Nairobi in February, March and June, to attend meetings in connection with the centralisation of agricultural research, the co-ordination of field trials with silicophosphate in the four East African territories, and the choice of a headquarters site for proposed new East African Research Organisation.

To Tabora in July to attend a meeting of administrative and technical officers on the possibilities of large-scale production of groundnuts in East Africa.

To Arusha Chini in June, with the Chemist, Coffee Research Station, Lyamungu, to investigate excessive soil salinity.

Soil map of Tanganyika Territory. At the request of the Chief Surveyor, Tanganyika, a soil map of the territory was prepared for a new edition of the "Atlas of the Tanganyika Territory" which is expected to appear in 1947. The map is a simplified edition of the Tanganyika section of the "Provisional Soil Map of East Africa" by G. Milne, the scale being 1: 4,000,000. The blank areas on Milne's map were filled in from information received from officers of the Geological Survey and of the Department of Agriculture. Only the general distribution of the chief soil types is shown, since sufficient information is not yet available to provide accurate boundaries for them. In the notes accompanying the map a short diagrammatic explanation of the "catena" is given.

Experiments with "cultivated fallow." As a result of suggestions put forward in my report on a visit to the Southern Highlands Province, Tanganyika, last year (vide report for 1945) large-scale field trials have been laid down by the Department of Agriculture on three estates in this province, at Mufindi, Rungemba and Dabaga. The soils are all laterised and are of poor structure and low fertility. The object of these trials is to find if the fertility can be raised by means of a "cultivated fallow" period before cropping. In all trials the soils have not been cultivated for many years, and it is doubtful if they were ever cultivated to any extent: here we are dealing with natural infertility and not man-made soil exhaustion. Two of the sites are in grassland and the third in open deciduous woodland ("miombo") which had been fire-protected for 14 years. In each area 5-acre plots were used, the treatments being,

(i) Cultivation to 12 in. depth by means of a tractor-drawn subsoil ripper.
(ii) Ripping plus 1 ton lime per acre.
(iii) Ripping plus 2 cwt. Uganda rock phosphate per acre.
(iv) Ripping plus 1 ton lime plus 2 cwt. rock phosphate per acre.
(v) 1 ton lime plus 2 cwt. rock phosphate per acre, without ripping.
(vi) Control.

Smaller plots, with subsidiary treatments using local bat guano deposits were added, and on one estate disc ploughing, with and without subsoil cultivation, was also included.

The object in using a subsoil ripper is to aerate the first foot of soil without disturbing the natural vegetation to any great extent, and the lime and phosphate, both produced in East Africa, were added to sweeten the raw subsoil and to stimulate plant growth. These soils are very low in organic matter and in exchangeable bases, even in the top six inches, and very heavy dressings of organic manure would be required in order to raise their fertility and water-holding capacity. If the organic content of the top foot of soil could be raised by greater root development and by increasing the amount of decomposing plant residues, the beneficial effects of inorganic fertilizers in a conservative crop-grass rotation would be greatly enhanced. However, it may be some time before the effects, if any, of this cultivated fallow show up, and it is intended that the fallow period should be two or three years.

Field trials with silicophosphate.—Food production in the native areas of East Africa is rapidly reaching a critical stage, and it is clear that means must be found to increase the yield per acre, in order that part of the land can be put down to temporary grass leys to restore soil structure. As most of the East African soils are deficient in phophate, it is probable that the yield per acre could be raised by applying silicophosphate, prepared from Uganda rock phosphate by calcining it with soda from Lake Magadi in Kenya. Experimental quantities of this fertiliser have been manufactured by the Industrial Research Board, Nairobi, and numerous field trials have been laid down in Kenya, Uganda and Tanganyika by the respective Departments of Agriculture. In places where supervision of the trials are not easy, unreplicated observation plots $\frac{1}{8}$th to $\frac{1}{2}$ acre in size have been used, and on Departmental experimental stations statistical lay-outs have been used. It was decided that the results from these three territories should be collated by the Soil Chemist, Amani, in order that a general picture may be obtained of the agronomic and economic possibilities of this method of raising fertility. It should be emphasized that silicophosphate would be used in a crop-grass rotation which would maintain the structure and organic content of the soils, and every effort would be made to prevent " soil-mining " by the African cultivators. The results are not yet complete, but preliminary reports show that silicophosphate is likely to have a beneficial effect in most areas, but with some soils applications of nitrogen as well may be required in order to derive full benefit from the phosphate. A large number of statistical field trials have been planned for 1947, many of them long-term experiments taking in a complete crop rotation.

Soil Salinity.—In collaboration with Mr. H. B. Stent, Chemist in the Coffee Research Station, Tanganyika, a short investigation was carried out on the excessive soil salinity which is threatening sugar-cane production on the Tanganyika Planting Co.'s estate at Arusha Chini, Northern Province. It was found that a satisfactory explanation of the sporadic occurrence of salinity on the estate could not be put forward unless a detailed " salt-map " of the area was prepared, and the company have engaged a chemist for this purpose.

D. W. Duthie,
Soil Chemist.

January, 1947.

Systematic Botany: Report for 1946.

During the year the overfull herbarium was transferred to a larger building which, although still inadequate, should serve until the collection can be transferred to a new herbarium.

Herbarium work.—During the year 127 accessions of botanical material totalling 5,139 specimens were received for naming from technical departments, commercial firms, the planting community and private individuals in East Africa.

Of these the more important collections were from:—

Uganda: A. S. Thomas, 965; J. W. Purseglove, 382 (Agricultural Department); W. J. Eggeling and I. R. Dale, 141 (Forestry Department).

Kenya: L. C. Edwards, 64; G. W. Jeffery and M. D. Graham, 291 (Agricultural Department); Miss C. Lucille Frazer, 52 (Soil Conservation Service); J. P. Glasgow, 54 (Tsetse Research); Mrs. D. R. Tweedie, 40; P. J. Greenway, 37 (E.A.A.R. Institute).

Tanganyika: L. G. Wigg, 69 (Forestry Department); W. D. Raymond, 19 (Government Chemist); H. J. van Rensburg, 143 (Pasture Research); P. J. Greenway, 478 (E.A.A.R. Institute); Mr. and Mrs. Moreau, 500 (E.A.A.R. Institute); Mrs. G. Macoun, 64 (Flower Paintings); Mrs. R. Culwick, 60 (Flower Paintings).

British Somaliland: P. E. Glover, 1,226 (Pasture Research).

As losses at sea by enemy action are no longer to be feared a start has been made with the distribution of the many duplicate specimens that have been accumulated at Amani during the war years and 6,347 specimens have been distributed, the majority to the following institutions:—

The Royal Botanic Gardens, Kew	2,868
The National Herbarium, Pretoria	1,404
The Imperial Forestry Institute, Oxford	1,072
The U.S. National Museum, Washington	185
The British Museum (Natural History) London	135
The New York Botanical Gardens, New York	103

The distribution of this accumulated material, most of it named, is reducing the congestion in the herbarium stores and it is hoped that all of it will have been disposed of before the end of 1947.

Only 44 specimens were received in exchange, mostly authenticated specimens, some of them exotics which are either cultivated or now wild in East Africa. Thanks are due for this material to the following:—C. G. Hansford, Department of Agriculture, Uganda (named leaf fungi); W. J. Eggeling, Forestry Department, Uganda (orchids); National Herbarium, Prétoria (essential oil geraniums); New York Botanical Gardens, New York (cover crops, green manures and essential oil plants); U.S. National Museum, Washington (shade and avenue trees).

There are still a number of specimens on loan for study to various specialists and institutions and further botanical material from the Herbarium has been loaned to the following:—

The British Museum, London (C. Norman, Umbelliferae 75 sheets); The Empire Cotton Growing Corporation, North Khartoum (J. B. Hutchinson, *Gossypium* and related genera 64); The Imperial Forestry Institute, Oxford (J. P. M. Brenan, miscellaneous trees 9); The National Herbarium, Pretoria (Euphorbiaceae and Gramineae 24); The Field Museum of Natural History, Chicago (E. E. Sherff, *Bidens* and *Coreopsis* spp. 131); The Royal Botanic Gardens, Kew (miscellaneous 5); The U.S. National Museum, Washington (E. P. Killip, Passifloraceae 97); The University of California (E. B. Babcock, *Crepis* spp. 12); Miscellaneous correspondents in East Africa and the United States 14.

Some of this study material has already been returned and thanks are due to the various specialists for naming and authenticating the specimens, their work considerably enhances the value of the collections in the Amani Institute Herbarium.

Nearly 3,100 determinations on plants from various collectors were made and reports and memoranda written on a wide range of subjects for numerous correspondents and institutions in different parts of the world.

In the course of determining specimens a further 13 type specimens were discovered in the Herbarium and sixteen new species from the Institute were published.

These new species together with those found during the year in the course of routine determinations now brings the total of known iso-types in the Amani Institute Herbarium up to three hundred and ninety-eight.

In the course of the year 660 sheets have been filed into the Herbarium making a total of 54,250 specimens available for study.

At the request of the Forestry Department, Tanganyika, *a Provisional List of Kibondei, Kinguru, Kishambaa and Kiuluguru Plant Names with their Botanical Equivalents* was prepared, it consists of 57 type-script pages. Copies of it have been distributed to the Royal Botanic Gardens, Kew, and to the Inter-Territorial Language Committee, Nairobi.

Copious notes have been provided to Dr. W. J. Eggeling in the revision of the second edition of his book *The Indigenous Trees of Uganda.*

Field Work.—In the company of Mr. N. R. Fuggles Couchman (Agricultural Department, Tanganyika) fourteen days were spent in February, on a vegetation and ornithological survey of Mt. Hanang, an extinct, isolated volcanic mountain, 11,215 ft. a.s.l. at the southern end of the Rift in Tanganyika.

Two ascents were made, one from the north-east, the other from the south-west as well as working around all the lower slopes of the mountain.

Some 187 plants were collected in quadruplicate, while my companion collected the birds. A number of new or little known species were found while some surprising extensions of geographical range from both north and south were recorded. A joint account of the vegetation and bird life is now being written for publication.

At the beginning of June, a week was spent in Dar-es-Salaam with the late Mr. Clement Gillman, C.B.E., discussing with him the southern sheets from 6°S of his vegetation map of Tanganyika. A meeting was held with the heads of the Survey Division, Department of Lands and Mines, at which Mr. L. G. Wigg (Forestry Department, Tanganyika) was also present, to discuss the possibilities of producing a 1:1,000,000 Vegetation Map of Tanganyika printed by the Survey Division. It was estimated that its production will be expensive and at present impossible through lack of trained staff. Owing to Mr. Gillman's untimely death the map on a 1:1,000,000 scale for the Vegetation Classification Committee of East Africa was not completed but a map on the scale of 1:2,000,000 was finished by Mr. Gillman for the American Geographical Society to whom it was sent. Preliminary negotiations are now proceeding with the Society for the use of the map in illustrating the report of the Committee on the Classification of East African Vegetation.

At the latter end of June, fifteen days were spent continuing the weed surveys of the Northern Province Wheat Scheme wheat fields in the Northern Province of Tanganyika. Whilst there the opportunity was taken on one day to ascend the southern slopes of Mt. Meru to an altitude of 10,300 ft. where specimens were gathered and photographs taken of a giant groundsel (*Senecio sp.*) which, according to the Kew authorities, is quite distinct from the three giant species found on Kilimanjaro. On my return through Moshi a visit to the aerodrome was made in the company of Mr. R. J. M. Swynnerton, M.C. (Agricultural Department, Tanganyika) to view the grass trials being held there, their object being to find a non-tussocky species suitable to the area.

Mr. Swynnerton very kindly spent another day with me when a rapid collecting trip was made around the eastern slopes of Kilimanjaro as far round to the north as Rombo. About 90 species in quadruplicate were collected on these surveys.

In August, at the request of, and in company of Mr. L. R. Doughty (Director of Cinchona Research Organisation, Amani) a hurried five day visit was made to the Nyanza Province, Kenya, with the object of making rapid vegetation surveys of the sites proposed for the establishment of *Cinchona* trial plots. Some 37 plant specimens were collected, in quadruplicate, and a report on the survey submitted.

A conference was attended on the 28 September at Moshi at which Sir Ian Heilbron and Professor J. L. Simonsen of the Colonial Products Research Council were present to discuss:—(1) Research into possible new uses for Colonial raw materials, minerals and otherwise; (2) Organisation of industrial research particularly of the aspect of research designed to translate laboratory findings into industrial practice; (3) Work on newer insecticides and (4) The chemotherapeutic side of trypanosomiases work. Some very interesting discussions resulted.

Programme for 1947. In spite of the forthcoming re-organisation of agricultural research in East Africa under a centralized authority there are several activities which must be continued by the Systematic Botany Section. These are:—

The routine determination of plants for officers of technical departments and private individuals.

The classification and naming of the following collections at Amani:—A. S. Thomas, Uganda, 963 specimens; P. E. Glover, British Somaliland, 1,226 specimens; the late Father Conrad's Herbarium Tanganyika 3,000 specimens.

Continue to help Dr. W. J. Eggeling in the revision of his *Indigenous Trees of Uganda.*

To prepare and revise a 3rd edition of the *Swahili-Botanical English Dictionary of Plant Names* that is now out of print.

To prepare and revise for the Vegetation Committee the draft of the Report on the Classification of East African Vegetation for publication along with the late Mr. Gillman's 1:2,000,000 map of the Vegetation of Tanganyika.

To assist the Kew authorities with the preparation of a proposed Flora of East Africa.

Supply information on a wide range of subjects in connexion with land usage to whoever may enquire for such information.

Time and routine work permitting, undertake rapid reconnaissance vegetation surveys of numerous areas in East Africa which are botanically unexplored.

Such surveys are desired by the home authorities and are essential if the contemplated Flora of East Africa is to be made more complete than it will be judging from our lack of knowledge of the vegetation of many remote and uninhabitated parts of East Africa.

P. J. Greenway,
Systematic Botanist.

January, 1947.

Plant Pathology—Report for 1946.

I have been on duty throughout the year. In November I paid a brief visit to the Lunzuwa Agricultural Experiment Station, Abercorn, Northern Rhodesia and then toured the main cassava growing areas of Nyasaland. The object of the visit was to ascertain, at first hand, the extent to which the brown streak virus of cassava occurs at different altitudes. Information on the distribution of this disease in parts of East Africa is scanty and since the main work of this section is now concentrated on the improvement of cassava, with particular reference to resistance to virus diseases, it is important that the distribution of these diseases should be known. So far I have not found brown streak above an altitude of 3,500 ft. The reasons for this are obscure. It is possible that the appropriate vector, a *Bemisia* sp., does not survive above this elevation or that for some unknown reason transmission does not take place at higher altitudes; even if this is so it does not explain why primary infections are not to be found. Primary infections of mosaic, on the other hand, occur at the maximum elevations at which cassava is grown, about 6,000 ft. a.s.l. Cassava has been introduced to higher elevations comparatively recently and it is therefore inconceivable to suppose that all the planting material procured from lower elevations could have been entirely free from brown streak, which is widespread at altitudes up to 2,000 ft. in Tanganyika and Nyasaland. Storey (*East African Agricultural Journal* Vol. 2, p. 36) has recorded that the effects of the disease are accentuated under relatively low temperature conditions, such as those met with during the cool

season at Amani. This observation has been repeatedly confirmed and in fact the effects can even be lethal. It is therefore conceivable that above 3,500 ft. where even lower winter temperatures prevail primarily diseased plants are killed outright. This is a possibility which requires experimental investigation.

Cassava Improvement. The amount of work involved in this long-term project of hybridisation and selection is increasing from year to year and I am now employed almost full-time on it. It may not be inappropriate to give here a brief resume of the procedure adopted in carrying out the work.

Controlled pollination of selected plants is carried out in the variety and species maintenance plots at Amani. The peak flowering period is usually from December to February.

The seeds are germinated in the laboratory and seedlings are raised in a greenhouse. When sufficiently developed the seedlings are multiplied vegetatively in the maintenance plots so as to provide sufficient cuttings for field trails. These latter are carried out in two stages; first a preliminary trial to eliminate the more susceptible clones, followed by replicated trials. Each replicated trial is carried on for from eight to ten months. On the basis of these trials the more promising clones are selected and further breeding work carried out with them as parents. Tests for complete immunity are carried out by grafting only those clones which completely escape infection in the field. Three years is the minimum time required to raise and test one generation; progress is therefore relatively slow.

Owing to drought the current year has been an unfavourable one for field work. The set of fruits was poor compared with previous years, with a consequent reduction in the anticipated yield of seeds.

Approximately 800 seeds were obtained from cassava x cassava crosses from which about 400 seedlings have been raised. From crosses between "tree" cassava hybrids and cassava, only 11 seeds were harvested and six seedlings raised. Ceara hybrids crossed with cassava yielded 117 seeds which gave 71 seedlings. *Manihot dichotoma* hybrids crossed with cassava gave 55 seeds from which 40 seedlings have been raised. All the above inter-specific crosses are second backcrosses.

Owing to the depredation of wild pigs it will be necessary to repeat the group of inter-specific crosses made in the 1944-45 season, when over 600 seedlings were raised. Pig wire was unobtainable and the field had to be fenced with barbed wire which proved inadequate. All the seedlings were uprooted in one night. These were replanted next day and many of them have survived, but the parentage records are, however, of no value because the plants got mixed. Nevertheless they are potentially valuable so they are being multiplied under arbitrary numbers and will be tested in the usual way.

The first series of replicated trials to be carried out at the Sisal Experimental Station, Mlingano (vide report for 1945), were terminated in July. The infection rate of both diseases was very high in susceptible clones—a circumstance which enables greater reliance to be placed on the behaviour of the more resistant clones. One hundred and eighty clones were tested in these trials. Of these seven clones resisted infection by mosaic and 47 were free from brown streak infection. Included in these are two ceara hybrids and three *Manihot dichotoma* clones which remained free from both diseases. The yields of edible roots of all varieties in these trials were very low owing to the fact that the plans had to be harvested before they were fully mature in order to free the land for further trials. Delayed maturity was due to the lack of seasonable rains. Furthermore, the roots of most of the inter-specific clones showing high resistance are not yet fully tuberous and therefore further back-crossing must be carried out to restore normal cassava-like roots. The best yield of edible root obtained so far has been from a second back-cross ceara hybrid which gave an average of 70 lbs. of fresh root per plant after 18 months growth. Unfortunately this clone is susceptible to both diseases.

The current year's field trials containing 120 clones were started in September.

A paper entitled " Breeding cassava for virus resistance " will appear in the January, 1947, number of the *East African Agricultural Journal*. In it a general account is given of the work done on cassava improvement up to date.

Future Programme.—The impending re-organisation of agricultural research in East Africa and the proposed siting of the new headquarters in the Limuru district of Kenya raises the question of future policy in regard to cassava breeding. The elevation of the new site is about 6,500 ft. above sea level, an altitude at which most varieties of cassava do not thrive and it would be unwise, therefore to attempt to carry out cassava breeding work there. I know of no other place in East Africa more suitable for cassava breeding and selection than Amani, which possesses the added advantage of being within reasonable distance of the plains where all field trials for disease-resistance must be conducted. Hence there is no case at present for transferring this work elsewhere. As there is a demand for high-altitude cassavas the proposed new station at Limuru will be useful for determining what varieties will thrive at high elevations.

Sweet Potato Virus Disease.—No success has yet been obtained in the search for the vector of this disease. Before carrying out controlled infection experiments it is essential to determine whether natural infection occurs in this district. With this object in view healthy cuttings taken from plants raised from seed in a greenhouse were planted between rows of diseased plants. They all died for want of rain. Replanting was carried out but up to the time of writing no infection has taken place.

This disease is probably more wide spread than it was originally thought to be. Dr. Wallace of the Department of Agriculture has found the disease in many parts of Tanganyika and within the last few weeks Dr. MacClean of the Department of Agriculture, Pretoria, has submitted photographs from plants growing in the Nelspruit district of the Eastern Transvaal which show symptoms apparently identical with those observed in parts of East Africa.

R. F. W. Nichols,
Assistant Plant Pathologist.

January, 1947.

Plant Physiology: Report for 1946.

This report refers only to the first eight months of 1946, as I was absent on leave from the 2nd of September.

In my last report I referred to the testing of several methods of measuring the penetration of rain and the movement of soil moisture under various vegetation types and on different slopes and soils at Shume in the West Usambaras. This was to form part of the preliminary investigation of methods for the examination of the soil-water-vegetation complex in special regions. Early results showed that the methods used, though capable of giving rapidly some of the information required, would be too slow, or, if equipment and staff were multiplied, too expensive for the rapid investigation of a large region covering many square miles. However, even these short trials provided interesting results which throw some light on the mechanism of soil erosion in this area.

The rate of penetration of rain into the Shume valley soils on a 15-20° slope was the same under grass as in undisturbed tilth. But, if the tilth of the cultivated land was compressed, even by merely walking once over it, then the penetration rate was greatly reduced and run-off increased. In fact, cultivated soils which could absorb up to 2 inches of rain per hour without run-off would rapidly erode under much less heavy rain when compressed by walking. The effect is well shown by native paths. After heavy rain they may be several inches lower than the surrounding soil.

Isolated trees or small groups of trees in this region also play an important part in the erosion of the valley slopes. In driving rain they catch much water which is deposited on the ground immediately below them, thus reinforcing the

rain reaching the ground directly. When the rain is heavy this local concentration is not easily absorbed, so run-off and erosion occur. The erosion is most marked in those sloping lands which are cultivated up to and around the bases of the trees, but it is also severe on heavily grazed grass slopes.

It is thought that these two results offer at least a partial explanation of the soil erosion in the forest slopes beyond Shume. In that area squatters have made clearings for dwellings and cattle pounds, and the cattle graze in the nearby forest. The soil erosion there is possibly due to (1) increased run-off along the compressed and bare cattle tracks, and (2) the trees which in isolated groups or at the edge of clearings concentrate the rain on the partially exposed soil under the heavily grazed herbage. Soil erosion does not normally occur in undisturbed clearings, for they are quickly invaded by annual herbs and grasses which put a protective covering over them.

The charge and discharge of soil moisture was measured under grass (Kikuyu grass) and maize. Young maize (up to about 2 feet high) used less water from the soil at 6 and 12 inches depth than did a good grass cover, but, as it grew larger, it rapidly depleted the soil water, and by the time it was 3 to 4 feet high it was using as much or more water than the grass. Rain seemed to penetrate more deeply into the soil under grass than under fully grown maize.

The diurnal variations in flow of a forest stream were also measured. In dry weather the flow was reduced during the day but recovered at night. Possible evaporation from its surface could not account for the large diurnal variations, and these are thought to be, in some part, due to the transpiration of the surrounding vegetation which intercepts the normal steady percolation of subsoil water. Similar results have been observed elsewhere.

A paper entitled " Environment and the Growth of the Potato (*S. tuberosum*) in Tropical East Africa " has been accepted for publication by the *Empire Journal of Experimental Agriculture*.

J. GLOVER,
Plant Physiologist.

LONDON
PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE
To be purchased directly from H.M. Stationery Office at the following addresses :
York House, Kingsway, London, W.C.2 ; 13a Castle Street, Edinburgh, 2 ;
39-41 King Street, Manchester, 2 ; 1 St. Andrew's Crescent, Cardiff ;
Tower Lane, Bristol, 1 ; 80 Chichester Street, Belfast
OR THROUGH ANY BOOKSELLER
1947
Price 6*d*. net

(57369) Wt. P. 497—4987 8/47 D.L.

S.O. Code No. 88-303-13-46*